

# The circumsource environment in AGNs

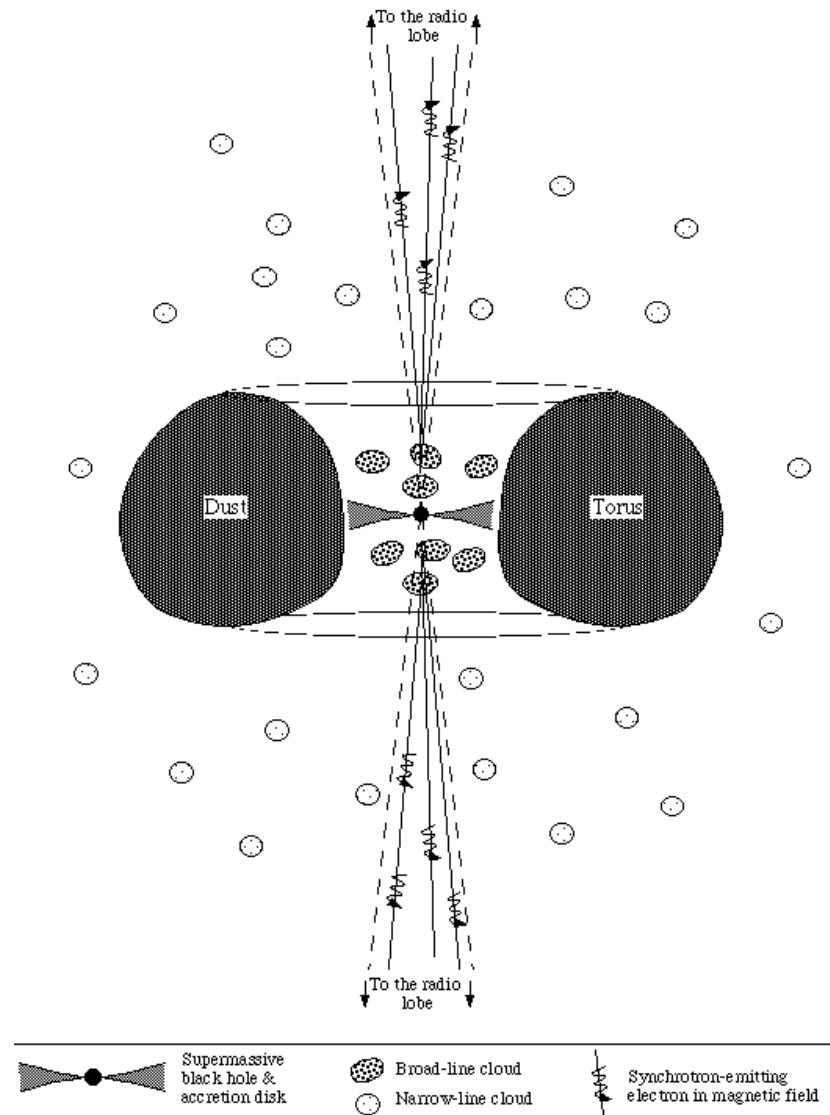
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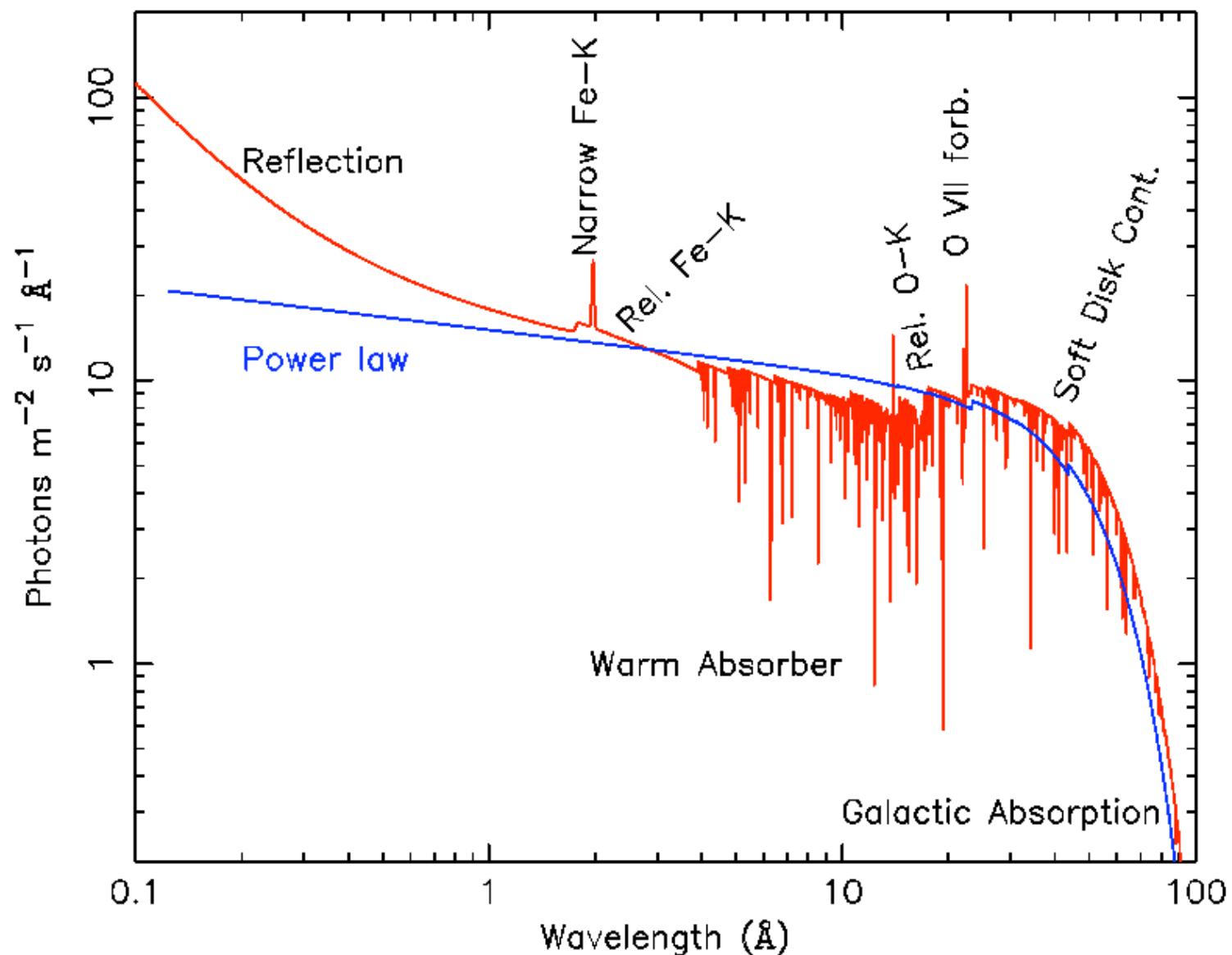
Thanks to: Rob van der Meer, Katrien Steenbrugge  
and others

# The AGN paradigm

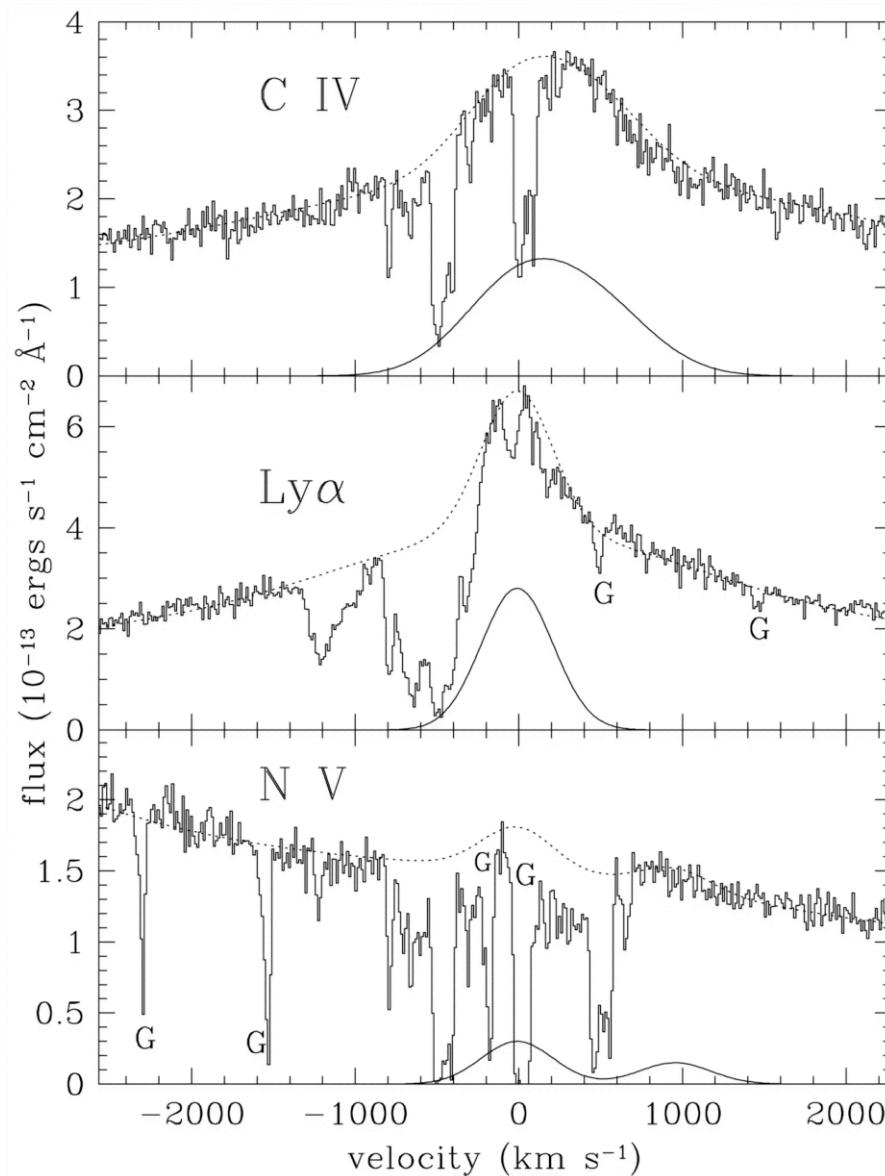
## The Active Galaxy Paradigm



# Model spectra

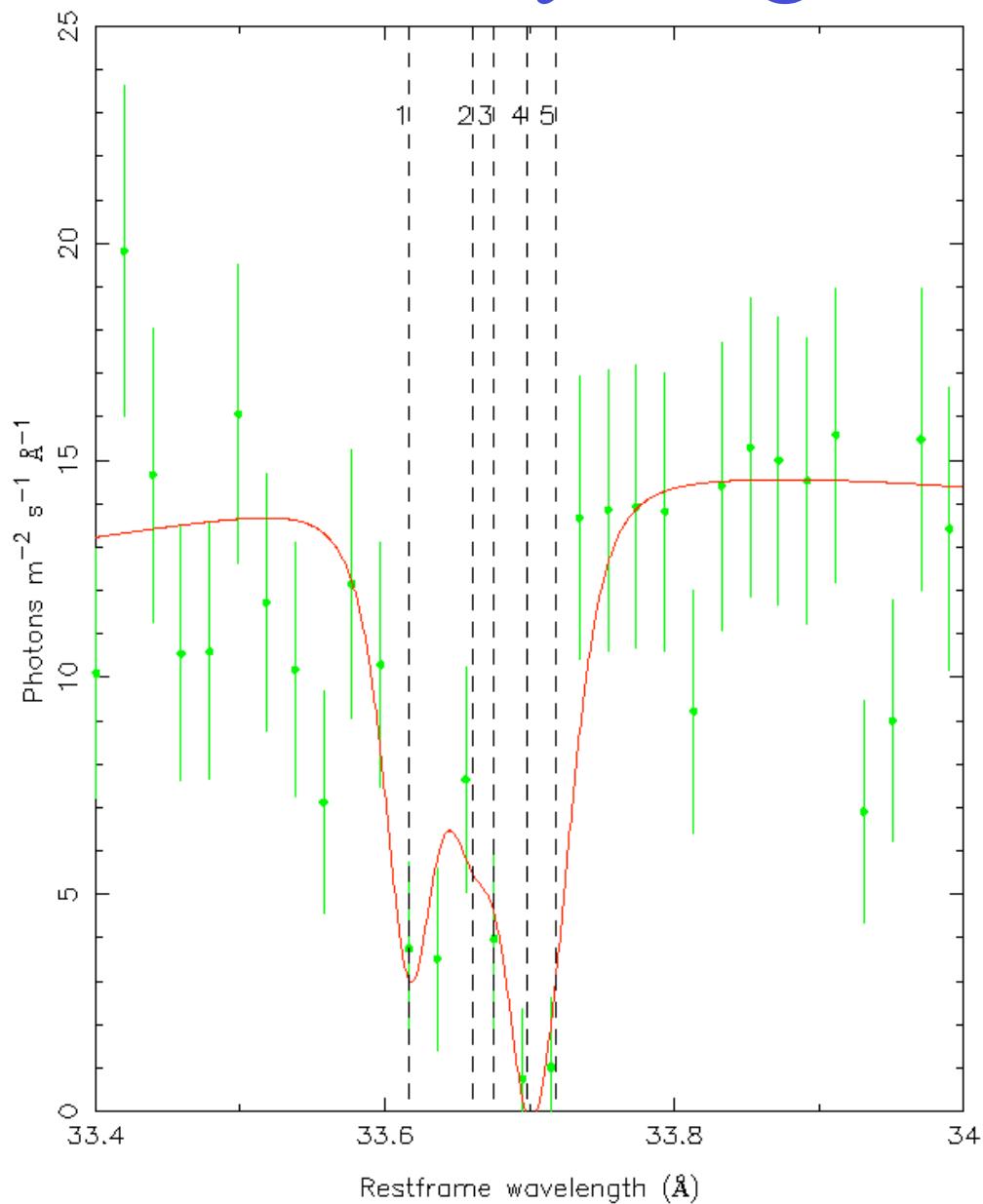


# Velocity diagnostics: UV



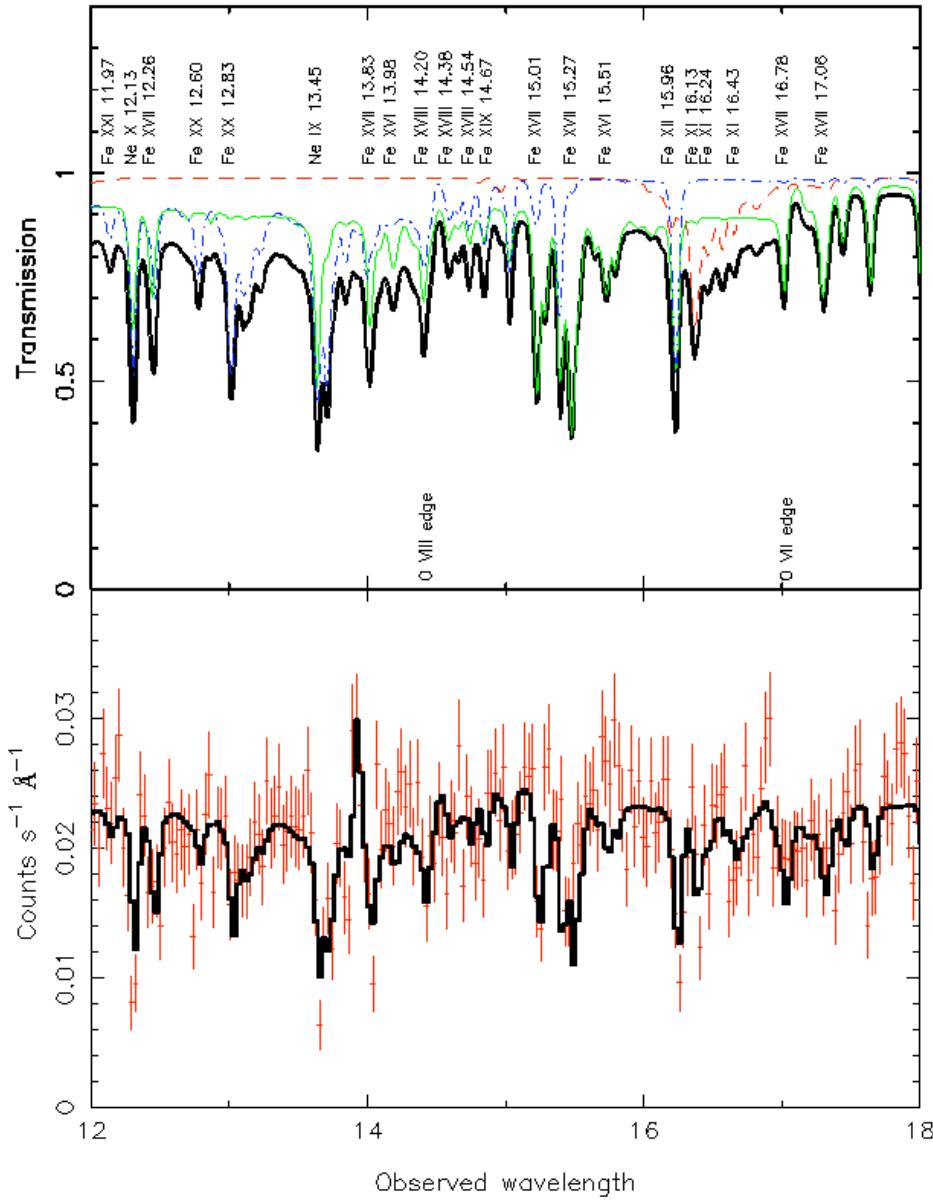
- NGC 5548, STIS,  
Arav et al. 2002
- details depend upon  
modeling of emission  
lines:
- both broad and narrow

# Velocity diagnostics: X-ray



- NGC 5548, LETGS,  
Kaastra et al. 2002
- poorer resolution than  
in UV
- but more ions

# Complex ionization structure



Fits to LETGS data  
NGC 5548 require at  
least 3 ionization  
components:

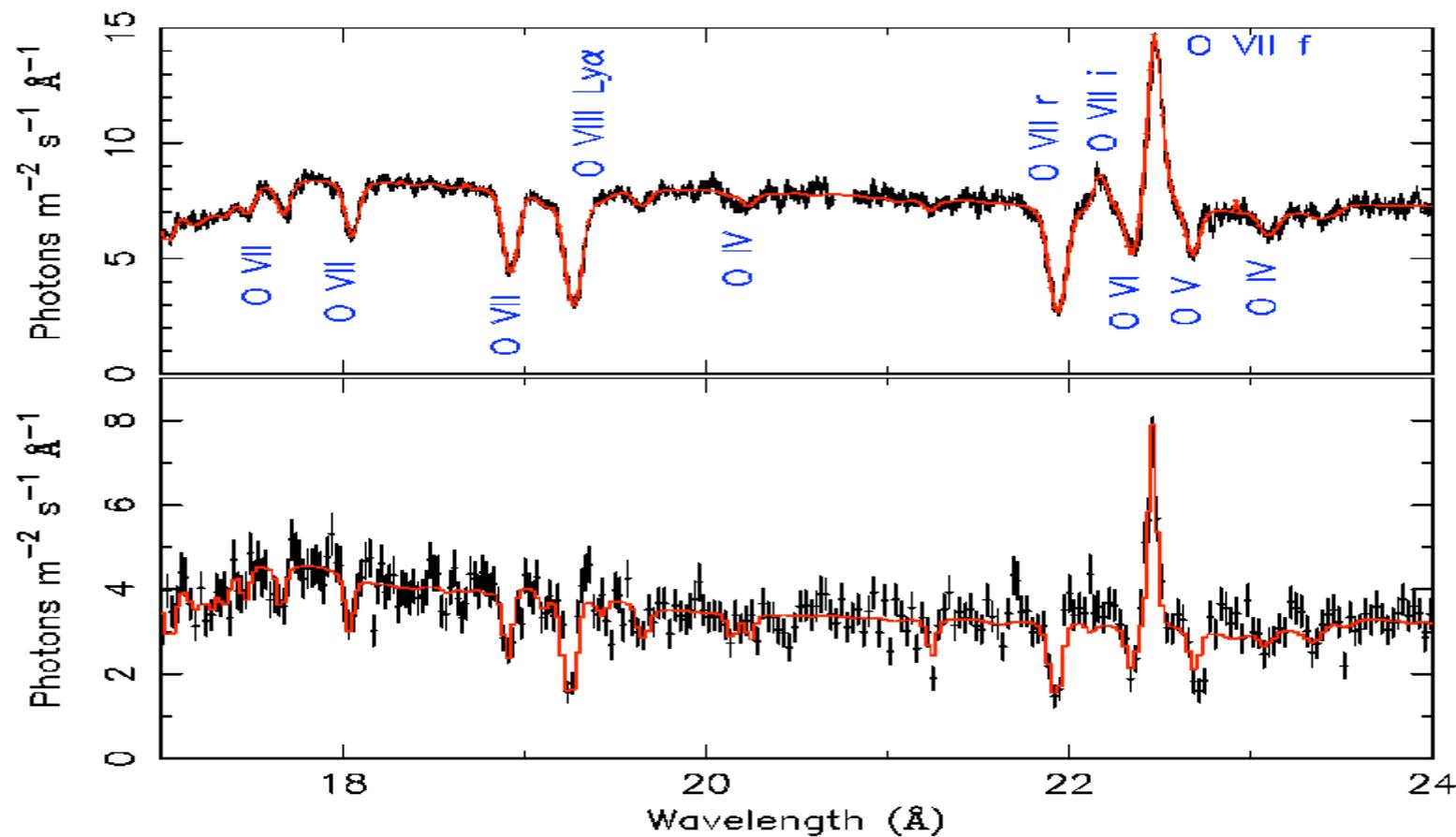
$$\log \xi = 0.5,$$

$$\log \xi = 1.9,$$

$$\log \xi = 2.9$$

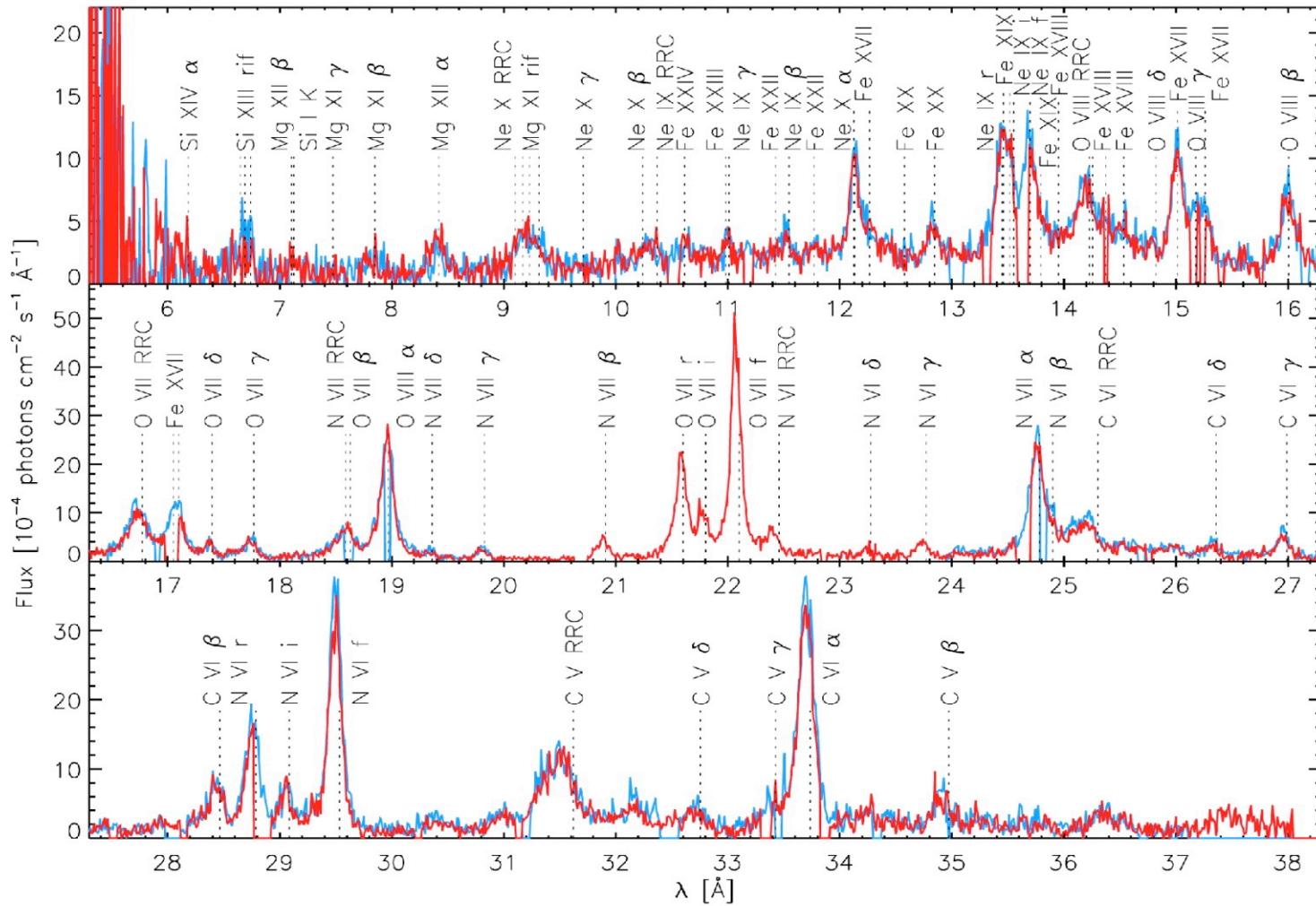
# Inner shell absorption lines

- First innershell lines: Fe UTA in IRAS 13349+2438 (RGS, Sako et al. 2001)
- Oxygen lines: NGC 5548 (RGS, LETGS, Steenbrugge et al. 2003)
- Mg, Si etc: NGC 3783 (HETGS, Kaspi et al. 2002; Behar & Netzer 2002)



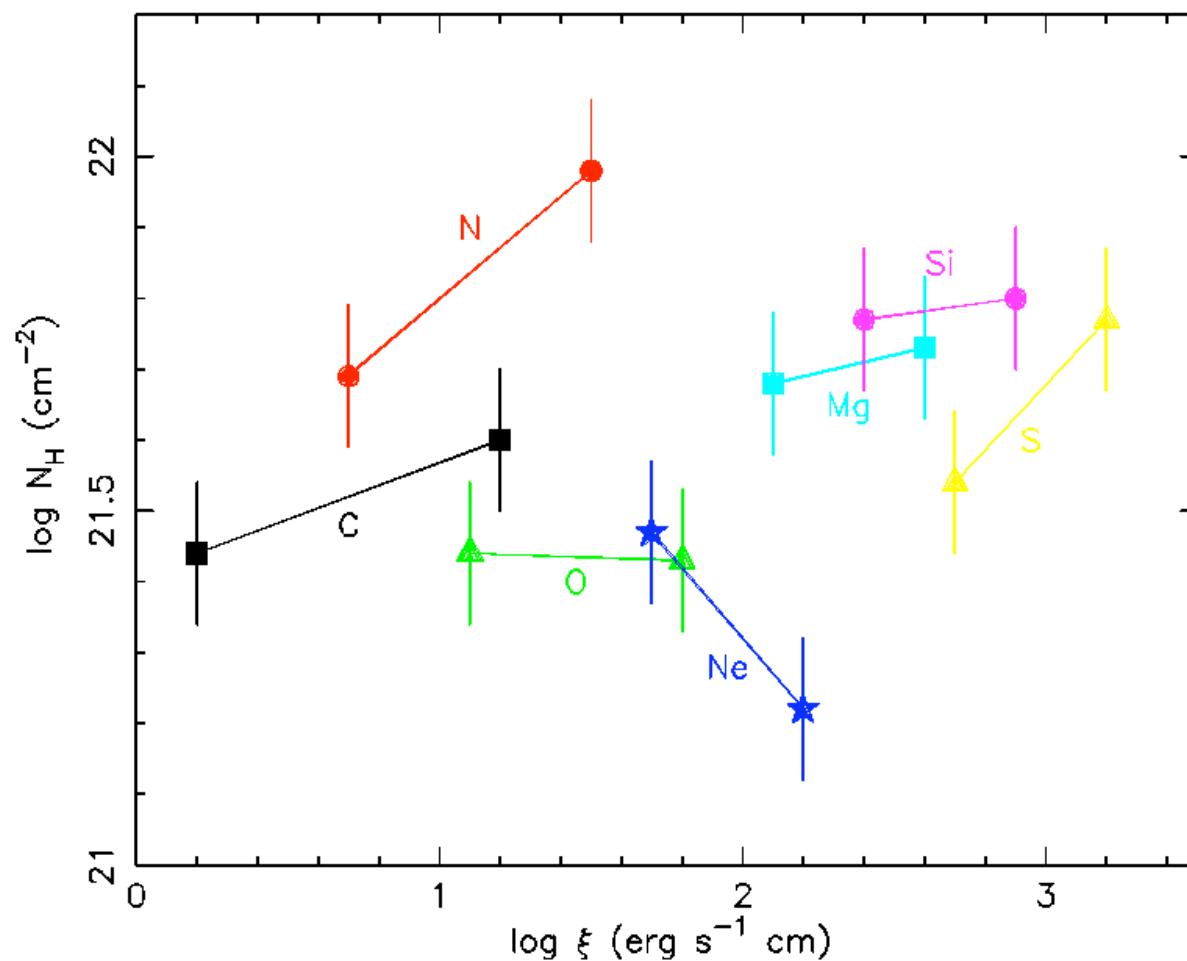
# AGN Unification: NGC 1068

- XMM-Newton RGS spectra: Kinkhabwala et al. 2002
  - Strong Radiative Recombination continua,  $kT$  few eV
  - Emission line spectrum dominated by H/He-like ions
  - Emission lines show blueshifts up to 600 km/s



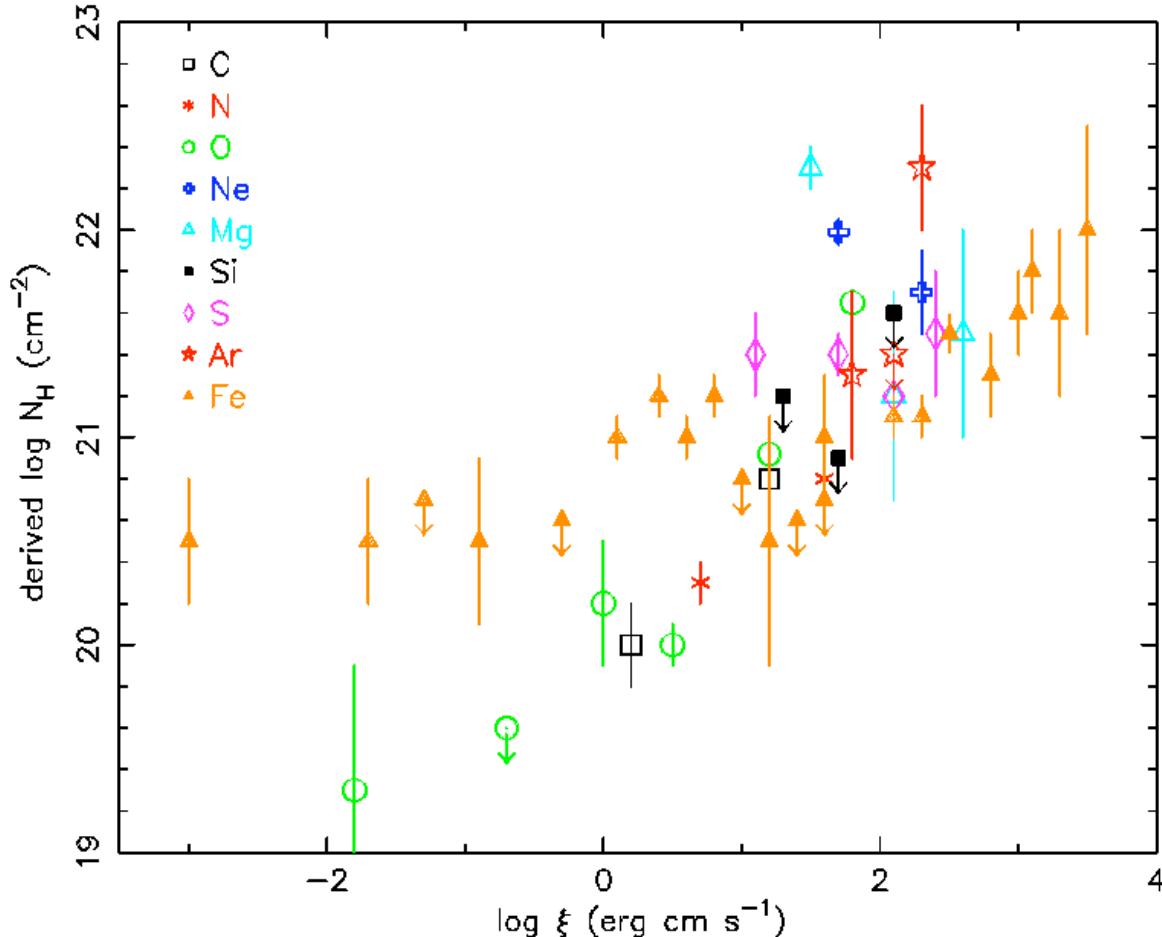
# Column density versus ionization

- Seyfert 2 galaxies
- use the emission lines
- NGC 1068 column densities from H/He-like ions
- (Brinkman et al. 2002, LETGS)



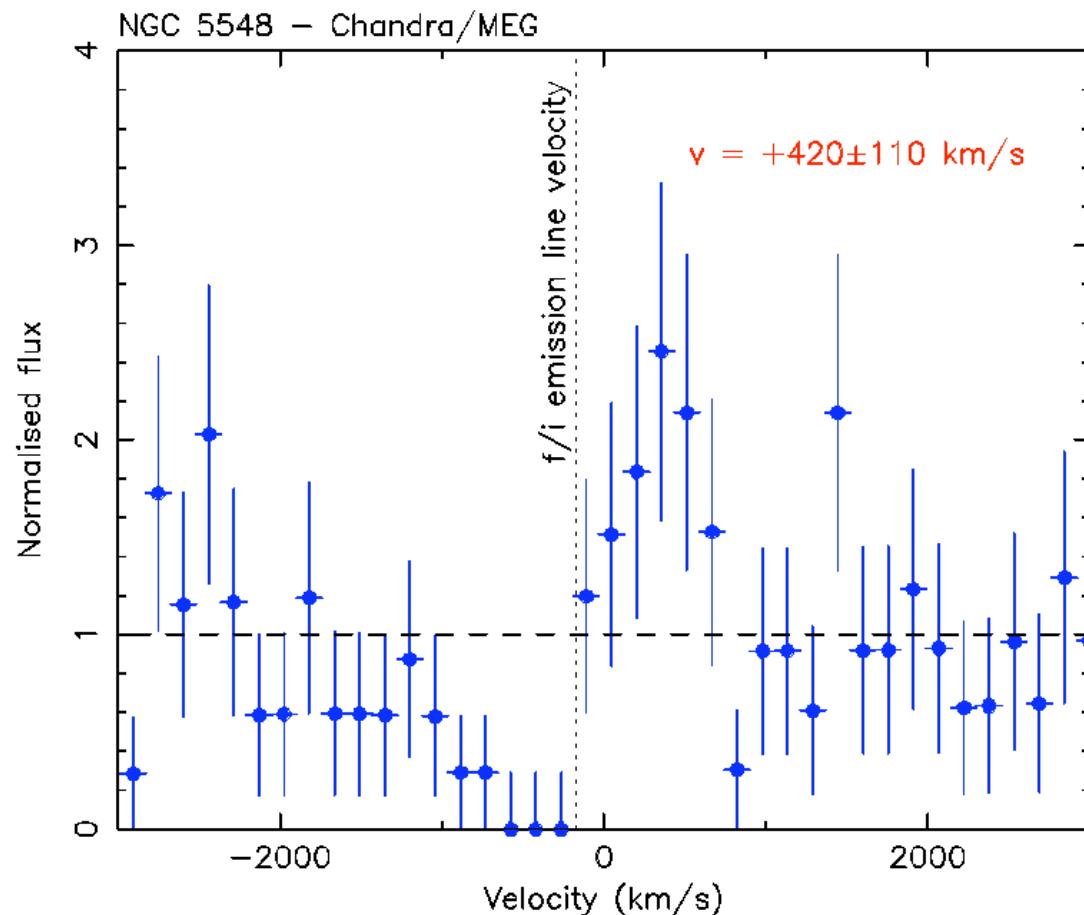
# Column density versus ionization

- Seyfert 1 galaxies:
- use the absorption lines
- NGC 5548 column densities from several ions
- (Steenbrugge et al. 2003, RGS)



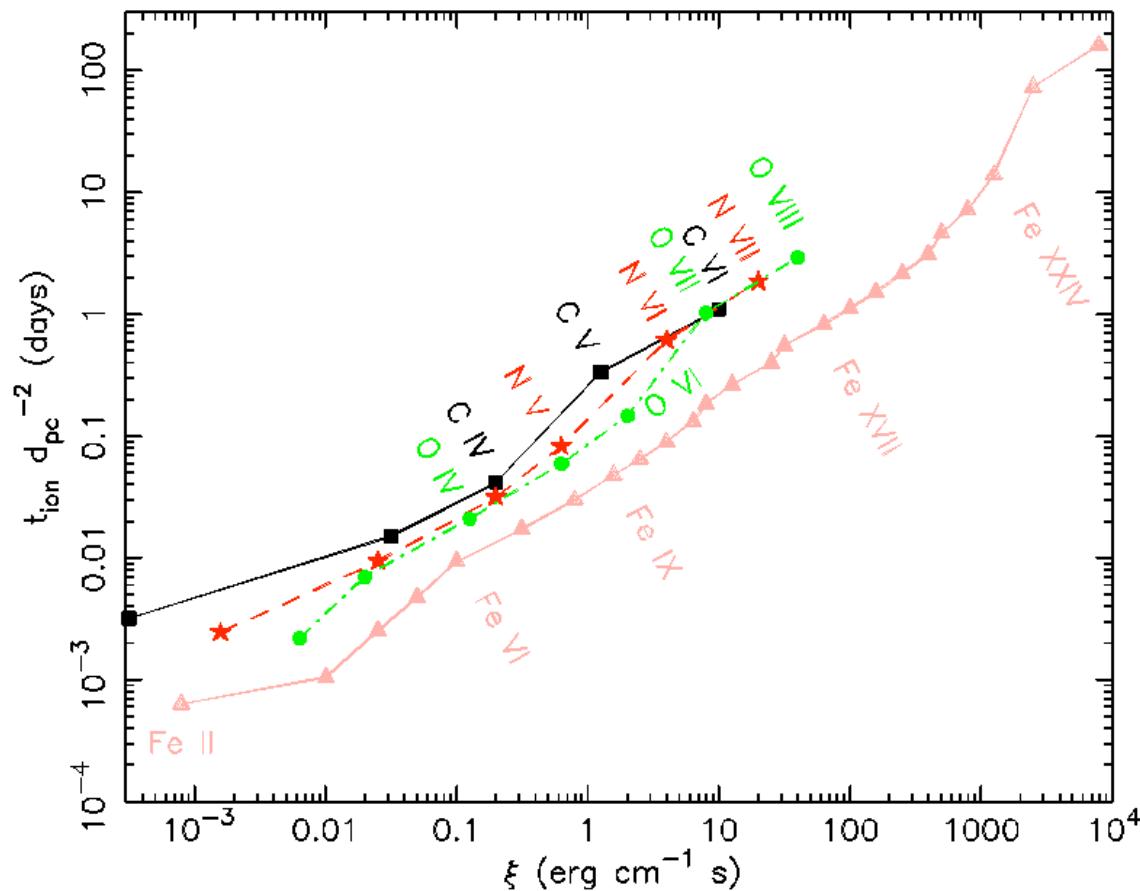
# P Cygni profiles?

- Some strong resonance absorption lines have redshifted emission components
- Example: NGC 5548 Chandra MEG (Kaastra et al. 2002)
- Show time variability
- If truly P cygni  $\Rightarrow$  geometry of the outflow
- Relation to forbidden emission lines ??



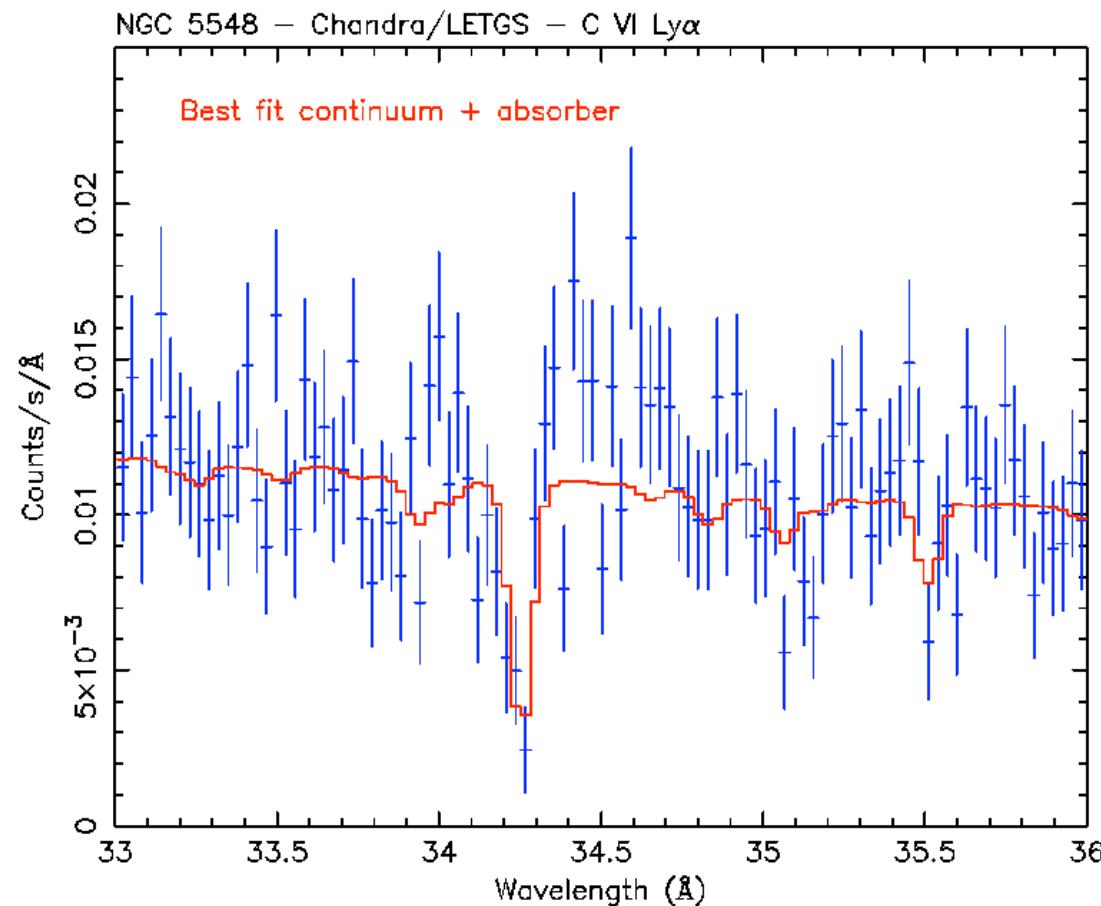
# Timing & Reverberation

- Different ions have quite different ionization time scales
- Also important: continuum variation basic time scale
- Also important: light travel time through a cloud
- Reverberation  $\Rightarrow$  spatial structure



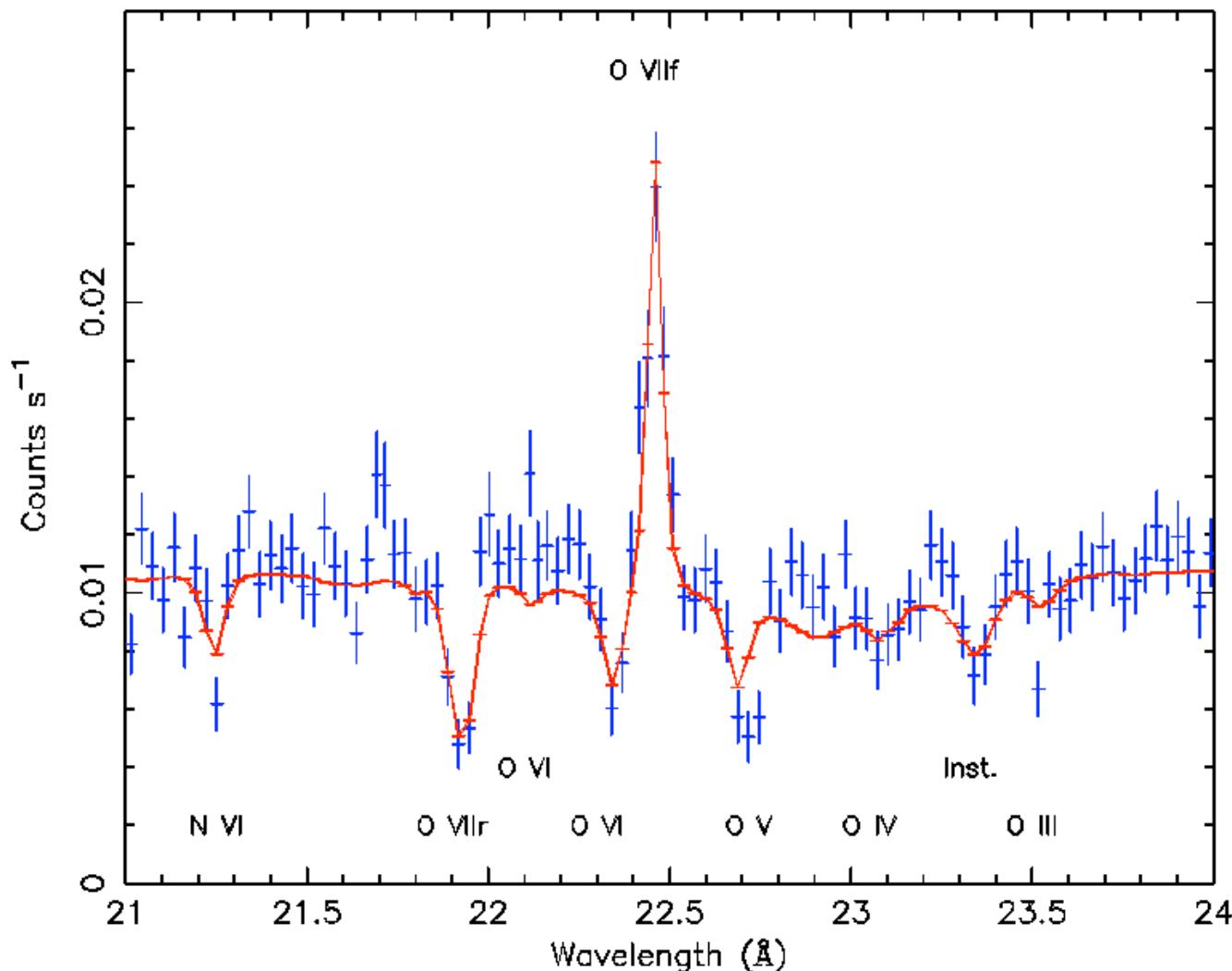
# Broad emission lines

- C VI Ly $\alpha$  has broad emission component in NGC 5548  
(LETGS, Kaastra et al. 2002)
- FWHM 10000 km/s
- amplitude about 20 %
- affects analysis of absorption lines



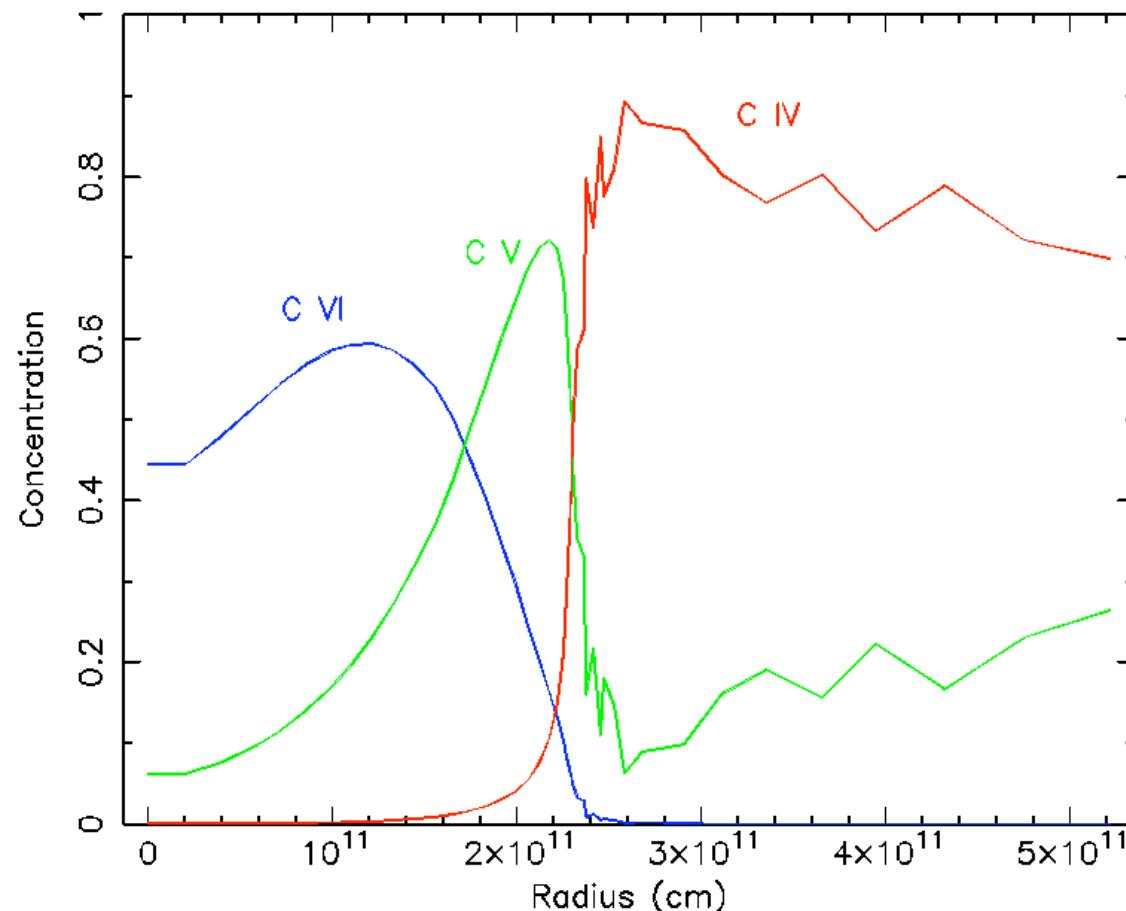
# More broad emission lines

- Around the O VII triplet in NGC 5548
- (Chandra LETGS 340 ks, Steenbrugge et al., see poster!)



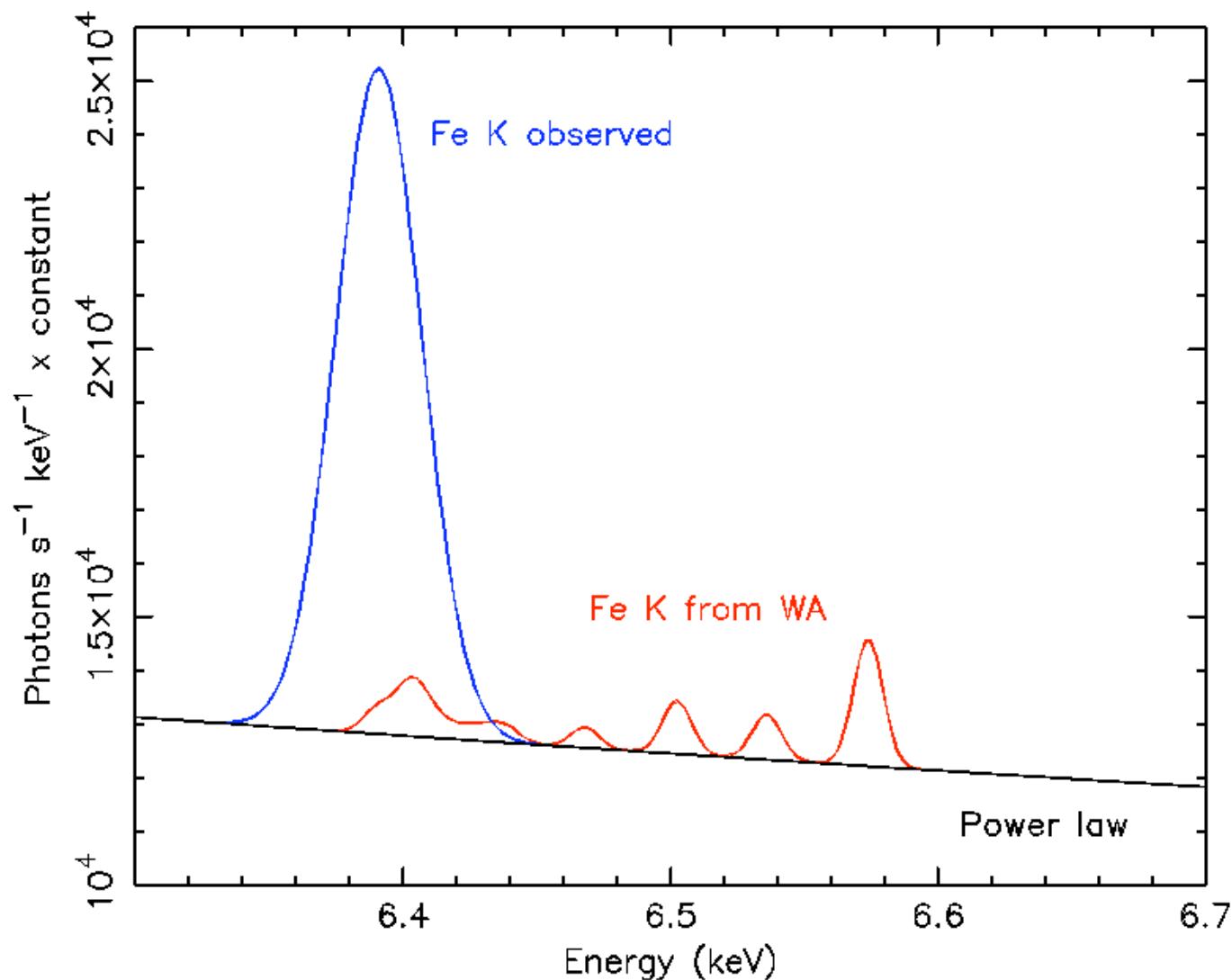
# Dynamics of broad lines

- XSTAR model for NGC 5548 continuum
- BLR parameters from Goad & Koratkar:
  - density  $10^{11.3} \text{ cm}^{-3}$
  - $\log U = -0.3$  ( $\log \xi = 1.3$ )
  - $N_H = 10^{23} \text{ cm}^{-2}$

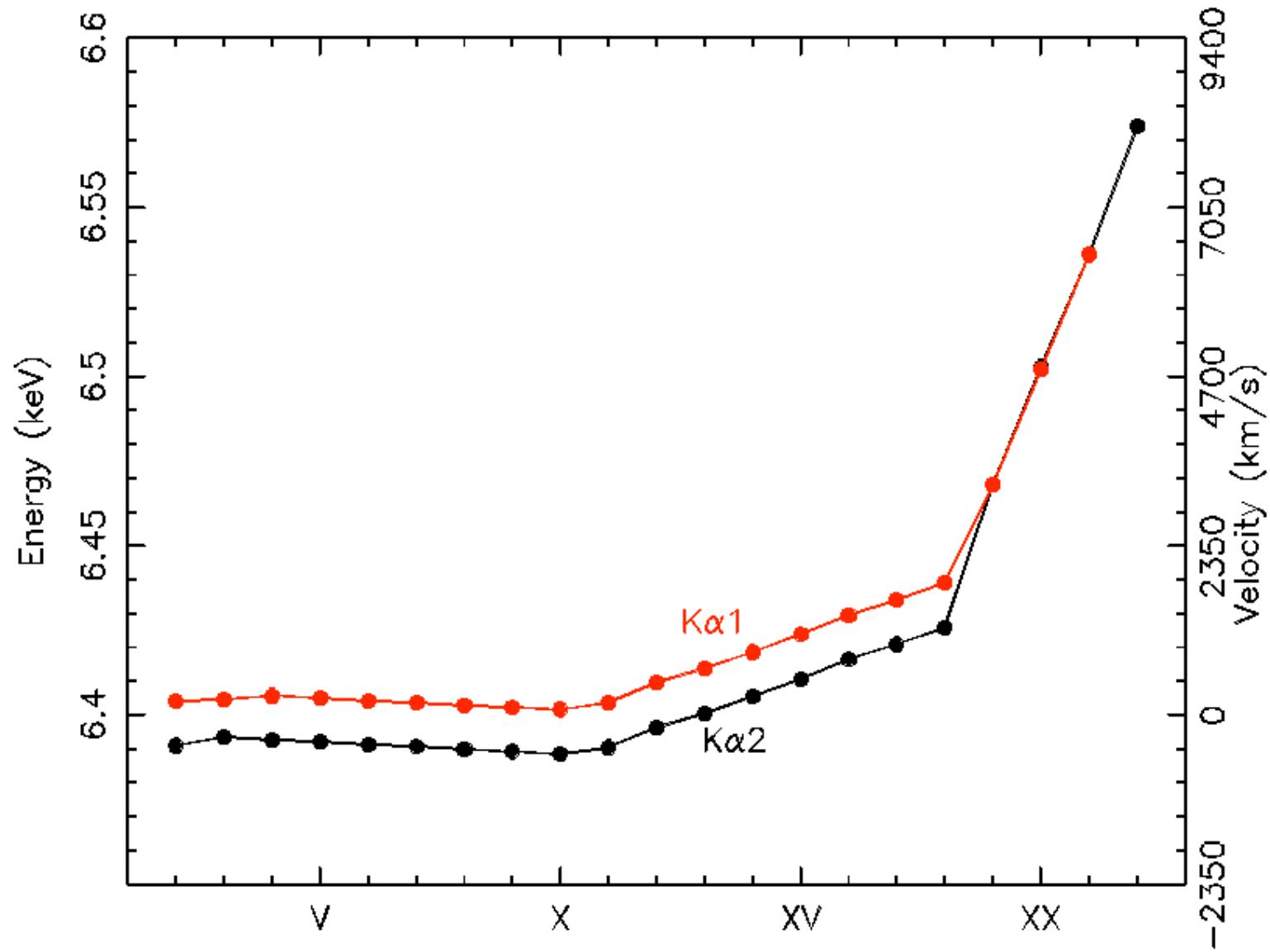


# Fe-K from the warm absorber?

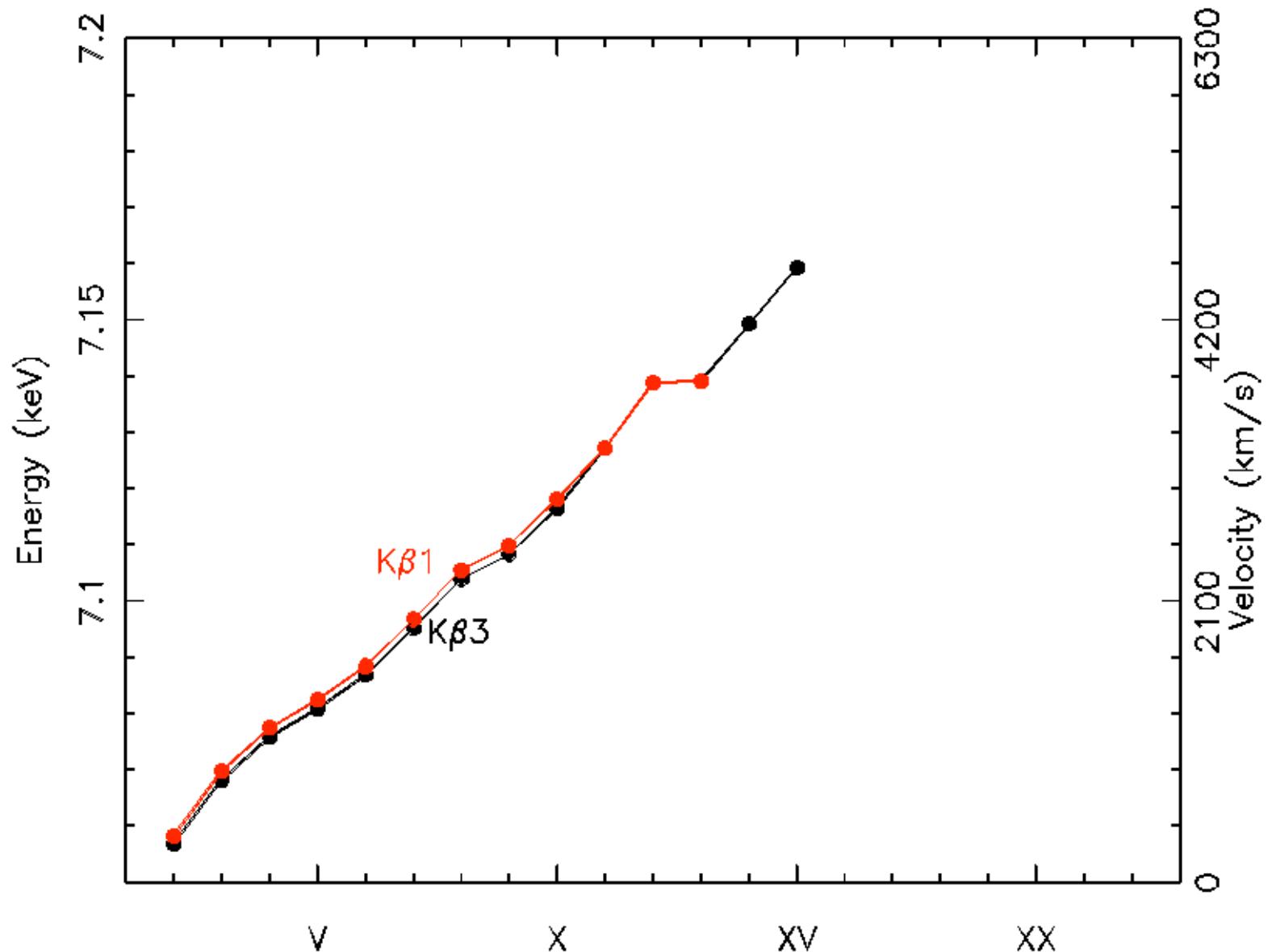
- Simulated Fe-K data for  $\Omega = 4\pi$  warm wind



# Iron K $\alpha$ diagnostics



# Iron K $\beta$ diagnostics



# Conclusions

- Expected benefits from Con-X:
- Higher sensitivity  $\Rightarrow$  weaker sources  $\Rightarrow$  larger samples
- Higher sensitivity  $\Rightarrow$  reverberation possible in brighter sources
- Higher sensitivity  $\Rightarrow$  possible to use important weaker diagnostic lines
- Higher spectral resolution at high E:  $\Rightarrow$  Fe-K diagnostics
- and finally, new unexpected breakthroughs (?!)